PATENT APPLICATION

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In re the Application of

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For: FUEL CELL STACK

SUBMISSION OF THE ANNEXES TO THE INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

Commissioner for Patents
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Sir:

Attached hereto are the annexes to the International Preliminary Report on Patentability (Form PCT/IPEA/409). The attached material replaces page 1 and the claims.

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DESCRIPTION

FUEL CELL STACK

Field of Invention

The present invention relates to a fuel cell. More particularly, the present invention relates to a fuel cell stack structure.

Background of the Invention

As illustrated in Japanese Patent Publication No. 2002-124291, and as illustrated in FIGS. 16 and 17, a fuel cell, for example, a Polymer Electrolyte Fuel Cell (PEFC) apparatus 10 includes a layering structure of a Membrane-Electrode Assembly (MEA) and a separator 18. The layering direction may be in any direction.

The MEA includes an electrolyte membrane 11 made from an ion exchange membrane and a pair of electrodes which includes an anode 14 disposed on one side of the electrolyte membrane and a cathode 15 disposed on the other side of the electrolyte membrane. A diffusion layer 13 may be disposed between the anode and the separator 18, and a diffusion layer 16 may be disposed between the cathode and the separator 18.

A first separator 18 disposed on one side of the MEA has a fuel gas passage 27 formed therein for supplying fuel gas (hydrogen) to the anode 14, and a second separator 18 disposed on the other side of the MEA has an oxidant gas passage 28 for supplying oxidant gas (oxygen, usually, air) to the cathode 17. The first and second separators 18 have a coolant passage 26 on opposite sides of the fuel gas passage 27 and the oxidant gas passage 28. In order to seal the fluid passages 26, 27 and 28 to each other, a rubber gasket 32 is disposed between adjacent fuel cells and an adhesive seal 33 is provided between the separators 18 disposed on opposite sides of the MEA of each fuel cell.

At least one (three at most) fuel cell 19 constructs a module. A number of modules are piled, and electrical terminals 20, electrical insulators 21, and end plates 22 are disposed at opposite end of the pile of modules to construct a stack of fuel cells (a fuel cell stack) 23. After tightening the stack of fuel cells between the end plates 22 in the fuel cell stacking direction, the end plates 22 are coupled to a fastening member 24 (for example, a tension plate) extending in the fuel cell stacking direction outside the pile of modules by bolts or nuts 25.

CLAIMS:

1. (Amended) A fuel cell stack comprising:

a plurality of multi-cell modules stacked in series, each of the plurality of multi-cell modules comprising a plurality of fuel cells layered in a fuel cell stacking direction and including opposite end fuel cells at opposite ends of the plurality of fuel cells layered; and

a restraining member, which extends in the fuel cell stacking direction over all of the plurality of multi-cell modules, for restraining each of the plurality of multi-cell modules in a direction perpendicular to the fuel cell stacking direction at the opposite end fuel cells of each of the plurality of multi-cell modules.

2. (Cancelled)

3. (Amended) A fuel cell stack according to claim 1, further comprising:

a connecting member for connecting adjacent multi-cell modules of the plurality of multi-cell modules to each other at opposing end fuel cells of the adjacent multi-cell modules.

4. (Amended) A fuel cell stack according to claim 1, wherein each of the opposite end fuel cells of each of the plurality of multi-cell modules is a dummy fuel cell generating no electric power.

5. (Amended) A fuel cell stack according to claim 1, wherein each of the opposite end fuel cells of each of the plurality of multi-cell modules has an extended portion formed by extending each of the opposite end fuel cells of each of the plurality of multi-cell modules outwardly in a direction perpendicular to the fuel cell stacking direction of each of the plurality of multi-cell modules, and each of the plurality of multi-cell modules is restrained by the restraining member in the direction perpendicular to a fuel cell stacking direction of each of the plurality of multi-cell modules at the extended portion.

6. A fuel cell stack according to claim 5, wherein the extended portion includes a hole formed therein and the restraining member is a restraining shaft extending through the hole formed in the extended portion.

7. A fuel cell stack according to claim 6, wherein the restraining shaft is a fuel cell stack tightening shaft.

8. A fuel cell stack according to claim 3, wherein the connecting member is a member different from the restraining member.

9. A fuel cell stack according to claim 8, wherein the connecting member is a

clip.

10. A fuel cell stack according to claim 8, wherein the connecting member is a member selected from the group composed of a bolt and a rivet.

11. A fuel cell stack according to claim 8, wherein each of the opposite end fuel cells of each of the plurality of multi-cell modules has an extended portion extended in a direction perpendicular to the fuel cell stacking direction of each of the plurality of multi-cell modules, and the connecting member is an ear portion formed in an extended portion of an end fuel cell of a first multi-cell module, the ear portion being bent so as to hold an extended portion of an end fuel cell of a second, adjacent multi-cell module.

12. A fuel cell stack according to claim 6, wherein the extended portion and the restraining shaft are electrically insulated from each other by an electric insulator.

13. A fuel cell stack according to claim 12, wherein the electric insulator is a bushing fixed to the hole formed in the extended portion of each of the opposite end fuel cells.

14. A fuel cell stack according to claim 13, wherein the bushing has a flange for preventing the bushing from being disengaged from the extended portion.

15. A fuel cell stack according to claim 12, wherein the electric insulator is a cylindrical member supported by the restraining shaft.

16. (Amended) A fuel cell stack according to claim 1, wherein each of the opposite end fuel cells of each of the plurality of multi-cell modules has an extended portion formed by extending each of the opposite end fuel cells of each of the plurality of multi-cell modules outwardly in a direction perpendicular to the fuel cell stacking direction of each of the plurality of multi-cell modules, and further comprising:

a deformation preventing member, disposed between extended portions of the opposite end fuel cells of each of the plurality of multi-cell modules, for preventing the extended portions of the opposite end fuel cells of each of the plurality of multi-cell modules from being deformed inboardly in the fuel cell stacking direction.

17. (Amended) A fuel cell stack according to claim 1, wherein the deformation preventing member includes an elastic or resilient member.